

What Is Claimed Is:

1 1. A method for lightpath provisioning in a reconfigurable optical network
2 comprising the steps of:
3 assigning an IP address to network addressable elements in said reconfigurable
4 optical network;
5 determining current topology of said reconfigurable optical network;
6 determining current resources in said reconfigurable optical network;
7 maintaining information regarding a state of said reconfigurable optical network;
8 receiving a request to create a lightpath from a source;
9 selecting a route for data to be transmitted between said source and a destination
10 based on said current resources of said reconfigurable optical network and said current
11 topology of said reconfigurable optical network;
12 generating an API call to create a lightpath, said API call results in a message;
13 forwarding said message to each network addressable element along said selected
14 route;
15 selecting an output channel at each node to be used as an input channel at a next
16 node;
17 reconfiguring an OLXC an input channel at a current node connected to said
18 output channel at said current node; and
19 receiving a response from said destination that said selected route is available.

1 2. The method according to claim 1, wherein the assigning step further
2 comprises the step of uniquely assigning said IP address to each network addressable

3 element used along said route through said reconfigurable optical network according to
4 an OLXC from which said network addressable element is sourced.

1 3. The method according to claim 1, further wherein said uniquely assigned
2 network addressable element may include one of a node, a channel and a link.

1 4. The method according to claim 1, wherein the assigning step further
2 comprises the step of assigning a unique IP address to a non-IP aware client.

1 5. The method according to claim 1, wherein the assigning step further
2 comprises the step of assigning a unique IP address to an OLXC port to which a non-IP
3 aware client is attached.

1 6. The method according to claim 1, wherein said information regarding said
2 state of said reconfigurable optical network is distributed throughout said reconfigurable
3 optical network.

1 7. The method according to claim 1, wherein said information regarding said
2 state of said reconfigurable optical network is maintained in a soft-state.

1 8. The method according to claim 1, further comprising the step of
2 forwarding a control message from each IP router to configure each router's OLXC
3 respectively in said allocated lightpath.

1 9. The method according to claim 1, further comprising the step of
2 forwarding an acknowledgement from each IP router indicating that said IP router's
3 respective OLXC has been configured.

1 10. The method according to claim 1, further comprising the steps of:
2 updating said current topology of said reconfigurable optical network; and
3 updating said current resources of said reconfigurable optical network.

1 11. The method according to claim 1, wherein information regarding said
2 resources of said reconfigurable optical network and information regarding said topology
3 of said reconfigurable optical network are distributed throughout said reconfigurable
4 optical network.

1 12. The method according to claim 1, wherein said current available resources
2 of said reconfigurable optical network is determined by sending a probe message to
3 determine available wavelengths along wavelength continuous routes.

1 13. The method according to claim 1, wherein said probe message uses a
2 wavelength availability vector equal to a number of said wavelengths on a first link of
3 said selected route, said wavelength availability vector being marked at each link along
4 said selected route indicating what wavelengths are available at each link along said
5 selected route.

1 14. The method according to claim 1, wherein said wavelength availability
2 vector being returned to said first link once said selected route has been traversed.

1 15. The method according to claim 1, further comprising the step of selecting
2 from among the available wavelengths using an arbitrary wavelength assignment scheme.

1 16. The method according to claim 1, further comprising the step of receiving
2 a request to create a lightpath from an originator by a first-hop IP router if said first-hop
3 IP router was not the source of said request to create a lightpath.

1 17. The method according to claim 1, further comprising the step of
2 forwarding said message using an IP router alert.

1 18. The method according to claim 1, wherein the step of selecting a route for
2 the data to be transmitted is performed by a first-hop router.

1 19. The method according to claim 1, wherein the step of selecting a route for
2 the data to be transmitted is performed by a pre-authenticated higher-level network
3 management system.

1 20. The method according to claim 1, wherein the step of determining current
2 topology is performed via OSPF link state advertisement.

1 21. The method according to claim 1, further comprising the step of carrying
2 said selected route in an IP datagram using an IP source route option.

1 22. The method according to claim 1, further comprising the step of carrying
2 said selected route in packet payload.

1 23. The method according to claim 1, wherein said selected route is specified
2 as a series of nodes.

1 24. The method according to claim 1, wherein said selected route is specified
2 as a series of links.

1 25. The method according to claim 1, wherein said selected route is specified
2 as a series of nodes and links.

1 26. The method according to claim 1, wherein said current topology and
2 resources comprise:

3 a total number of active channels;
4 a number of allocated channels;
5 a number of preemptable channels;
6 a number of reserved restoration channels;
7 Shared Risk Link Groups throughout the reconfigurable optical network; and
8 optional physical layer parameters for each link.

1 27. A method for lightpath provisioning in a reconfigurable optical network
2 comprising the steps of:

3 assigning an IP address to network addressable elements in said reconfigurable
4 optical network;
5 determining current topology of said reconfigurable optical network;
6 determining current resources in said reconfigurable optical network;
7 maintaining information regarding a state of said reconfigurable optical network;
8 receiving a request to create a lightpath from a source;

3 naming each network addressable element in said reconfigurable optical network;
4 determining current topology in said reconfigurable optical network;
5 determining current resources in said reconfigurable optical network;
6 requesting establishment of a lightpath; and
7 allocating said lightpath.

1 32. A system for lightpath provisioning in a reconfigurable optical network
2 comprising:

3 means for assigning an IP address to each network addressable element in said
4 reconfigurable optical network;

5 means for receiving a request to create a lightpath from a source;

6 means for determining current topology of said reconfigurable optical network;

7 means for determining current resources in said reconfigurable optical network;

8 means for maintaining information regarding a state of said reconfigurable optical
9 network;

10 means for selecting a route for data to be transmitted between said source and a
11 destination based on said current resources of said reconfigurable optical network and
12 said current topology of said reconfigurable optical network;

13 means for generating an API call to create a lightpath, said API call results in a
14 message;

15 means for forwarding said message to each network addressable element along
16 said selected route;

17 means for selecting an output channel at each node to be used as an input channel
18 at a next node;

19 means for reconfiguring an OLXC an input channel at a current node connected to
20 said output channel at said current node; and

21 means for receiving a response from said destination that said selected route is
22 available.

1 33. The system according to claim 1, wherein the means for assigning further
2 comprises means for uniquely assigning said IP address to each network addressable
3 element used along said route through said reconfigurable optical network according to
4 an OLXC from which said channel is sourced.

1 34. The system according to claim 1, further wherein said uniquely assigned
2 network addressable element may include a node, a channel and a link.

1 35. The system according to claim 1, wherein said means for assigning further
2 comprises means for assigning a unique IP address to a non-IP aware client.

1 36. The system according to claim 1, wherein said means for assigning further
2 comprises means for assigning a unique IP address to an OLXC port to which a non-IP
3 aware client is attached.

1 37. The system according to claim 1, wherein said information regarding said
2 state of said reconfigurable optical network is distributed throughout said reconfigurable
3 optical network.

1 38. The system according to claim 1, wherein said information regarding said
2 state of said reconfigurable optical network is maintained in a soft-state.

1 39. The system according to claim 1, further comprising means for forwarding
2 a control message from each IP router to configure each router's OLXC respectively in
3 said allocated lightpath.

1 40. The system according to claim 1, further comprising means for forwarding
2 an acknowledgement from each IP router indicating that said IP router's respective
3 OLXC has been configured.

1 41. The system according to claim 1, further comprising:
2 means for updating said current topology of said reconfigurable optical network;
3 and
4 means for updating said current resources of said reconfigurable optical network.

1 42. The system according to claim 1, wherein information regarding said
2 resources of said reconfigurable optical network and information regarding said topology
3 of said reconfigurable optical network are distributed throughout said reconfigurable
4 optical network.

1 43. The system according to claim 1, wherein said current topology of said
2 reconfigurable optical network is determined by sending a probe message to determine
3 available wavelengths along wavelength continuous routes.

1 44. The system according to claim 1, wherein said probe message uses a
2 wavelength availability vector equal to a number of said wavelengths on a first link of
3 said selected route, said wavelength availability vector being marked at each link along
4 said selected route indicating what wavelengths are available at each link along said
5 selected route.

1 45. The system according to claim 1, said wavelength availability vector is
2 returned to said first link once said selected route has been traversed.

1 46. The system according to claim 1, further comprising means for selecting
2 from among the available wavelengths using an arbitrary wavelength assignment scheme.

1 47. The system according to claim 1, further comprising means for receiving a
2 request to create a lightpath from an originator by a first-hop IP router if said first-hop IP
3 router was not the source of said request to create a lightpath.

1 48. The system according to claim 1, further comprising means for forwarding
2 said message using an IP router alert.

1 49. The system according to claim 1, wherein the means for selecting a route
2 for the data to be transmitted is performed by a first-hop router.

1 50. The system according to claim 1, wherein the means for selecting a route
2 for the data to be transmitted is performed by a pre-authenticated higher-level network
3 management system.

1 51. The system according to claim 1, wherein the step of determining current
2 topology is performed via OSPF link state advertisements.

1 52. The system according to claim 1, further comprising means for carrying
2 said selected route in an IP datagram using an IP source route option.

1 53. The system according to claim 1, further comprising means for carrying
2 said selected route in packet payload.

1 54. The system according to claim 1, wherein said selected route is specified
2 as a series of nodes.

1 55. The system according to claim 1, wherein said selected route is specified
2 as a series of links.

1 56. The system according to claim 1, wherein said selected route is specified
2 as a series of nodes and links.

1 57. The system according to claim 1, wherein said current topology and
2 resources comprises:

3 a total number of active channels;

4 a number of allocated channels;

5 a number of preemptable channels;

6 a number of reserved restoration channels;

7 Shared Risk Links Groups throughout the reconfigurable optical network; and

8 optional physical layer parameters for each link.

1 58. A system for lightpath provisioning in a reconfigurable optical network
2 comprising:

3 means for assigning an IP address to each network addressable element in said
4 reconfigurable optical network;

5 means for determining current resources in said reconfigurable optical network;

6 means for determining current topology of said reconfigurable optical network;

7 means for receiving a request to create a lightpath from a source;

8 means for maintaining information regarding a state of said reconfigurable optical
9 network;

10 means for selecting a route for data to be transmitted between said source and a
11 destination based on said current resources of said reconfigurable optical network and
12 said current topology of said reconfigurable optical network;

13 means for generating an API call to create a lightpath, said API call results in a
14 message;

15 means for forwarding said message to each network addressable element along
16 said selected route;

17 means for selecting an output channel at each node to be used as an input channel
18 at a next node;

19 means for reconfiguring an OLXC an input channel at a current node connected to
20 said output channel at said current node;

21 means for receiving a response from said destination that said selected route is not
22 available; and

23 means for releasing resources allocated along a partially created lightpath.

1 59. The system according to claim 1, wherein said response is accomplished
2 using an ICMP message.

1 60. The system according to claim 1, wherein said response is accomplished
2 using a CR-LDP message.

1 61. The method according to claim 1, wherein said response is accomplished
2 using a RSVP message.

1 62. A system for lightpath provisioning in a reconfigurable optical network
2 comprising:

3 means for naming each network addressable element in said reconfigurable
4 optical network;

5 means for determining current topology in said reconfigurable optical network;

6 means for determining current resources in said reconfigurable optical network;

7 means for requesting establishment of a lightpath; and

8 means for allocating said lightpath.

1 63. A method for removing a lightpath in a reconfigurable optical network
2 comprising the step of explicitly forwarding a message to release said lightpath, said
3 message initiated by a first-hop router.

1 64. A method for removing a lightpath in a reconfigurable optical network
2 comprising the steps of allowing said lightpath to be released by expiration as a result of
3 a soft-state, wherein said soft-state fails to timely forward a message to create said
4 lightpath in order to maintain said lightpath.

1 65. A system for removing a lightpath in a reconfigurable optical network
2 comprising means for explicitly forwarding a message to release said lightpath by a first-
3 hop router.

1 66. A system for removing a lightpath in a reconfigurable optical network
2 comprising means for allowing said lightpath to be released by expiration as a result of a
3 soft-state, wherein said soft-state fails to timely forward a message to create said
4 lightpath in order to maintain said lightpath.

IDS 2000-0051